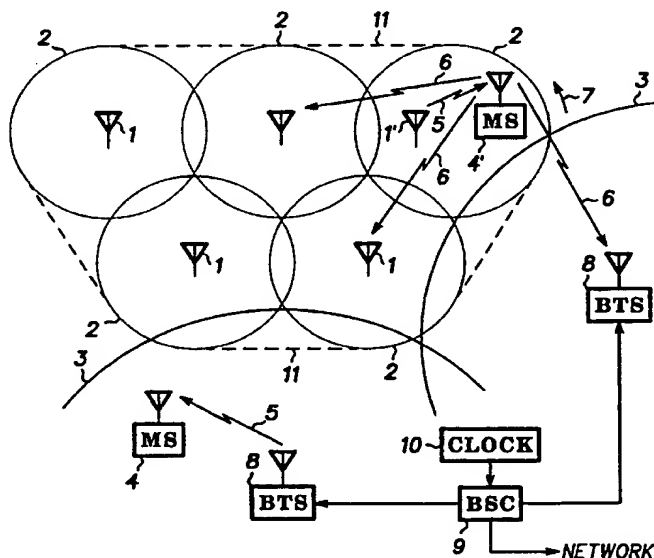




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(54) Title: MOBILE COMMUNICATION NETWORK AND METHOD OF OPERATION THEREOF



(57) Abstract

A GSM mobile communication network comprising a group of picocells (2) or microcells within the coverage (11) of a simulcast carrier is arranged to instruct a mobile station (4, 4') to transmit on a BCCH frequency and the corresponding freed timeslot available to the picocellular heads (1) or to a base transceiver station is utilised to make interference measurements to assist in frequency allocation between the cells of the network or to enable all the picocellular heads to make uplink measurements on a mobile station to determine the best picocell for intercellular handover. This latter mode of operation overcomes the problem of frequency ambiguity associated with conventional downlink measurements by the mobile stations prior to handover in a simulcast system.

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MOBILE COMMUNICATION NETWORK AND METHOD OF OPERATION THEREOF

Field of the Invention

The present invention relates to a mobile communication network (particularly but not exclusively the Global System for Mobile communication (GSM) network) comprising a group of cells associated with a simulcast carrier and to a method of operation of such a network.

Background of the Invention

In a cellular mobile communication system each of the mobile stations communicate with a typically fixed base station. Communication from the mobile station to the base station is known as uplink and communication from the base station to the mobile station is known as downlink. The total coverage area of the system is divided into a number of separate cells each covered by a single base station. The cells are typically geographically distinct with an overlapping coverage area with neighbouring cells. As a mobile station moves from the coverage area of one cell to the coverage area of another cell, the communication link will change from being between the mobile station and the base station of the first cell to being between the mobile station the base station of the second cell. This is known as a handover.

Specifically, some cells may lie completely within the coverage of other larger cells. These are known as hierarchical cells and an example is so called microcells which are used to provide a high traffic capacity in high traffic areas. Typically the microcells are small and a large number of cells can be implemented in a limited area. A mobile station moving into the microcell will

be handed over from the overlaying cell, known as the macrocell. This frees up resource at the macrocell and hierarchical cell thus provide the possibility of a large coverage area combined with high traffic capacity.

All base stations are interconnected by a fixed network. This fixed network comprises communication lines, switches, interfaces to other communication networks, various controllers required for operating the network and the base stations themselves. A call from a mobile station is routed through this network to the destination specific for this call. If the call is between two mobile stations of the same communication system the call will be routed through the network to the base station of the cell in which the other mobile station currently is. A connection is thus established between the two serving cells through the network. Alternatively, if the call is between a mobile station and a telephone connected to the Public Switched Telephone Network (PSTN) the call is routed from the serving base station to the interface between the cellular mobile communication system and the PSTN. It is then routed from the interface to the telephone by the PSTN.

A simulcast system is one in which all the cells within an area transmit an identical signal, at the same frequency, at all times. This broadcast signal contains control information and is used as a beacon to determine relative signal strength. Additionally, each cell within the simulcast system can transmit a second frequency upon which traffic can be relayed. The second frequency is different from cell to cell although it may be reused if there is sufficient distance to mitigate interference. As a mobile is likely to remain within this simulcast system during the period of a call and the simulcast carrier effectively creates a single larger umbrella cell, very few intercell (between simulcast cells and external cells) handovers will be required. Consequently, the majority of handovers will be of the intracellular (between the simulcast cells) type. Since there is a single umbrella cell identification the mobile cannot identify the smaller target cells beneath this umbrella cell: i.e. the handover process cannot be mobile assisted i.e. based on the mobile

station differentiating between broadcast carriers. Rather than mobiles identifying cells, the cells identify the target mobiles by making measurements of the strength of neighbour uplink traffic. The stronger the neighbour measurement compared to measurements made by other cells the more probable that the observed mobile will handover into that cell.

The cells can be microcells or picocells for example. Picocells are commonly used inside buildings (where radio propagation through the external walls or internal partitions in the 900 MHz or 1800MHz bands is severely attenuated by metal structures for example) and microcells are commonly used in somewhat larger regions such as city centres for example.

In order to make measurements of the mobile stations in the surrounding simulcast cells the base stations will retune to the frequencies of the traffic carriers in these cells. However, as the frequencies are reused the base stations will measure a combined signal level of the desired mobile station and all mobile stations allocated the same time slot in cells using the same traffic carrier frequency. This may lead to inaccurate measurements and degraded handover performance.

Summary of the Present Invention

One object of the invention is to overcome or alleviate such a disadvantage.

More generally, the invention provides additional flexibility in a mobile network and enables more information to be obtained about the state of the network, as will become apparent.

According to a first aspect of the invention, there is provided mobile communication network comprising a group of cells with a common simulcast

carrier carrying signaling information, at least a first cell being associated with a first traffic carrier, wherein at least a first mobile station is arranged to intermittently perform an intracell handover to the common simulcast carrier, and means for performing measurements of the radio environment when the mobile station is using the common simulcast carrier.

In one embodiment the intracell handover is from the first traffic carrier to the common simulcast carrier.

According to a feature of the invention a clock means is arranged to generate a signal instructing said intracell handover and said clock means is located in a fixed part of the network and is arranged to transmit said signal to one or more mobile stations.

In one embodiment a signal instructing said intracell handover is arranged to be generated in response to a measurement of received signal level or quality of a radio transmission from a mobile station.

According to a different feature of the invention, one or more base stations are arranged to measure a received signal level and/or quality of the signal transmitted by the mobile station on the common simulcast carrier and a handover is determined in response to the measurements.

In one embodiment the mobile communication network is a GSM network.

According to a second aspect of the invention, there is provided a base station operating in a communication system having a group of cells with a common simulcast carrier carrying signaling information and at least a first cell being associated with a first traffic carrier, the base station comprising means for directing a mobile station to intermittently perform an intracell handover to the common simulcast carrier i, and means for performing measurements of

the radio environment when the mobile station is using the common simulcast carrier.

According to a third aspect of the invention, there is provided a method of operating a mobile communication network with a group of cells (2) with a common simulcast carrier carrying signaling information and at least a first cell being associated with a first traffic carrier, comprising the steps of: intermittently performing an intracell handover of a first mobile (4,4') station to the common simulcast carrier, and performing measurements of the radio environment when the mobile station (4,4') is using the common simulcast carrier.

Brief Description of the Drawings

A preferred embodiment is described below by way of example only with reference to Figures 1 and 2 of the accompanying drawings, wherein:

Figure 1 is a schematic diagram of a GSM mobile communication network in accordance with this invention, employing a simulcast BCCH carrier which extends over a group of picocells or microcells;

Figure 2 is a timeslot:frequency diagram of a base station in the network of Figure 1.

Description of a Preferred Embodiment

Referring to Figure 1, the GSM network illustrated comprises a group of picocellular heads 1 defining respective picocells 2, each picocell 2 representing the coverage of a respective broadcast carrier signal associated

with each picocellular head. Associated with each of the picocellular heads is a traffic carrier, each traffic carrier having a different frequency from those of at least its nearest neighbouring picocells.

A further simulcast carrier is transmitted from each picocellular head 1 and extends over all the above picocells as illustrated at 11.

The above group of picocells interfaces with in this case two macrocells 3 defined by carriers transmitted from base transceiver stations 8, which are in turn linked by fixed communications links to a common base station controller 9 and thence to the rest of the network. In a variant, the picocells 2 could be microcells and an umbrella cell could overlies the picocells or microcells.

In operation, a control signal generated e.g. by a clock 10 and transmitted over the fixed communications links or alternatively generated in response to a detection of radio signal level and/or quality below a predetermined threshold is broadcast to a mobile station 4 and (as indicated by radio signal 5) instructs the mobile station to perform an intracell handover to an uplink carrier frequency and timeslot corresponding to the simulcast carrier. Such a signal 5 could also be transmitted by a picocellular head 1' to a mobile station 4' as illustrated, the change in frequency being represented by arrow 7.

The structure of signal 5 will now be described in more detail with reference to Figures 2 before describing the response of the mobile stations 4 and 4'.

Figure 2 shows the frequency:timeslot distribution of the various signals transmitted by a base transceiver station (BTS) 8 to its associated macrocell or by a picocellular head 1 to its associated picocell. The group of frequencies (or more accurately frequency bands) f_1 to f_5 available to a given (macro or pico) cell will typically not include any frequencies in common with those used by neighbouring cells, in order to avoid interference. In other respects the

frequency:timeslot distributions of the respective macrocells and picocells are similar.

The carrier is transmitted in slot SL corresponding to timeslot 0 and frequency f_5 , the beacon frequency. The carrier comprises the FCCH, SCH, BCCH, PCH and AGCH channels which carry respective types of control and information data to the mobile stations within the cell, as defined in the GSM specifications. In order to ensure that the most powerful transmission is on the beacon frequency (to enable it to be identified by mobile stations within the cell in order to enable them to access the above control and information data) any slots not used on frequency f_5 are filled with dummy bursts.

The above frequency:timeslot structure is conventional in GSM mobile communication networks. It is now assumed that a call has been established to or from a mobile station within a cell of interest. The mobile station will be communicating using a timeslot TS1 on the traffic carrier frequency of the corresponding picocell. The signal 5 will be carried to the mobile station through a control channel in the time slot SL, for example on the FACCH (Fast Associated Control Channel). The signal 5 will result in the mobile station changing to a time slot TS2 on the BCCH frequency.

Having described the intracellular handover of a mobile station to a new traffic channel on the BCCH carrier, the resulting operation will now be described further with reference to Figure 1. There are a number of choices.

Firstly it will be noted that the timeslot TS1 previously used by the picocellular head 1' to transmit traffic to the mobile within its picocell is no longer used, since this function has been taken over by the radio unit responsible for the simulcast transmission. Accordingly the transceiver (not shown) associated with the picocellular head 1' can be retuned to another frequency during this timeslot and used to make e.g. interference measurements or measurements of mobile station signal level and/or quality

on that frequency. For example a mobile station communicating in a time slot TS3 on the traffic frequency f_1 of the neighbour picocell can be measured by changing the receive frequency from f_2 to f_1 during time slot 6. Alternatively, the receiver can continue to receive on the same frequency f_2 and thus measure the interference level in the absence of the mobile station. This information can then be passed back up to a base station controller 9 and thence to an appropriate part of the fixed network controlling frequency allocation between cells or picocells. A similar procedure could be followed by a base transceiver station 8 associated with a macrocell 3 (or with a microcell, not shown).

Secondly all the picocell transceivers within the coverage 11 of the simulcast BCCH can be arranged to measure the signal level from the mobile station as they all have the BCCH carrier frequency f_5 in common. This information can then be used to select the neighbouring picocell 2 receiving the highest power and/or signal quality for intercellular handover as the mobile station approaches that picocell. This is a desirable facility because the conventional method of cell selection for intercellular handover, involving downlink measurements by mobile stations, the results of which are transmitted to the base transceiver stations, can result in ambiguity as a result of two mobile stations in non-neighbouring picocells but within the simulcast coverage area 11 transmitting on the same frequency. Difficulties can also arise when the mobile stations are fast-moving - e.g. in trains.

Preferably, the mobile station will return to a traffic carrier following the measurements. However, this traffic carrier can be that of a different picocell if the measurements indicate that that will result in better performance.

According to one feature of the invention the signal 5 is generated by a clock which for example periodically instigates a new measurement. The clock can be located centrally in the network and can be distributed through the fixed network to the appropriate picocell heads for transmission to the mobile

stations. Alternatively, the process can be instigated in response to measurements of the current radio transmission. Information of interference levels and possible transmission quality for neighbour base stations is of most importance when the current transmission quality is unsatisfactory and a hand over is required for improved quality. For example, if a mobile station has an unsatisfactory quality level for the current serving picocell it can be instructed to handover to the BCCH carrier where all picocell will be able to measure the signal level from the mobile station. A handover to a given picocell head can then be determined in response to these measurements. Preferably by selecting the picocell which receives the strongest signal level from the mobile station.

The measurement process can thus be instigated in response to a measurement of the signal level or quality of the current transmission. Preferably, the measurement process would be instigated when these levels fell below a given threshold.

According to a feature of the invention the measurements are repeated for a number of mobile stations thereby building up information of the distribution of mobiles within the network.

In a variant of the above embodiment, a mobile station is temporarily assigned to a slot of the simulcast carrier when it originates a call. Uplink measurements similar to those described above are then made at the picocellular heads (or at base transceiver stations associated with microcells) and an appropriate picocell or microcell is assigned to the mobile station on the basis of such measurements. In this embodiment the intracellular handover is thus not from another traffic carrier but rather from a non-active state.

Although an embodiment of the invention has been described in the context of a GSM mobile cellular communication network, it should be noted that the

invention is not restricted to such a network but that it is also applicable to other mobile cellular networks such as the NADC network in the USA and the PDC network in Japan.

Claims

1. A mobile communication network comprising a group of cells (2) with a common simulcast carrier carrying signaling information, at least a first cell being associated with a first traffic carrier, wherein at least a first mobile station (4,4') is arranged to intermittently perform an intracell handover to the common simulcast carrier, and means for performing measurements of the radio environment when the mobile station (4,4') is using the common simulcast carrier.
2. A claim as claimed in claim 1 wherein the intracell handover is from the first traffic carrier to the common simulcast carrier.
3. A mobile communication network as claimed in claim 1 wherein a clock means (10) is arranged to generate a signal instructing said intracell handover.
4. A mobile communication network as claimed in claim 3 wherein said clock (10) means is located in a fixed part of the network and is arranged to transmit said signal to one or more mobile stations.
5. A mobile communication network as claimed in claim 1 wherein a signal instructing said intracell handover is arranged to be generated in response to a measurement of received signal level or quality of a radio transmission from a mobile station.
6. A mobile communication network as claimed in claim 1 wherein one or more base stations (1,1',8) are arranged to measure a received signal level and/or quality of the signal transmitted by the mobile station on the common simulcast carrier.

7. A mobile communication network as claimed in claim 1 wherein a handover is determined in response to the measurements.
8. A mobile communication network as claimed in claim 1 wherein base stations in different cells (1,1',8) are arranged to measure transmitted signal level and/or signal quality from a plurality of mobile stations in such new uplink channels and the network is arranged to process the measurements to determine the distribution of mobile stations within the network.
9. A mobile communication network as claimed in claim 1 wherein a base station (1') of a cell from which the intracell handover is made is arranged to be re-tuned to receive on a frequency different from the first traffic channel while traffic is being handled by the common simulcast carrier.
10. A mobile communication network as claimed in claim 9 wherein the base station (1') of the cell from which the intracell handover is made is arranged to be used to monitor interference on the first traffic carrier while traffic is being handled by the new uplink channel.
11. A mobile communication network as claimed in any preceding claim which is a GSM network.
12. A base station (1,1') operating in a communication system having a group of cells (2) with a common simulcast carrier carrying signaling information and at least a first cell being associated with a first traffic carrier, the base station (1,1') comprising means for directing a mobile station (4,4') to intermittently perform an intracell handover to the common simulcast carrier i, and means for performing measurements of the radio environment when the mobile station (4,4') is using the common simulcast carrier.

13. A method of operating a mobile communication network with a group of cells (2) with a common simulcast carrier carrying signaling information and at least a first cell being associated with a first traffic carrier, comprising the steps of: intermittently performing an intracell handover of a first mobile (4,4') station to the common simulcast carrier, and performing measurements of the radio environment when the mobile station (4,4') is using the common simulcast carrier.

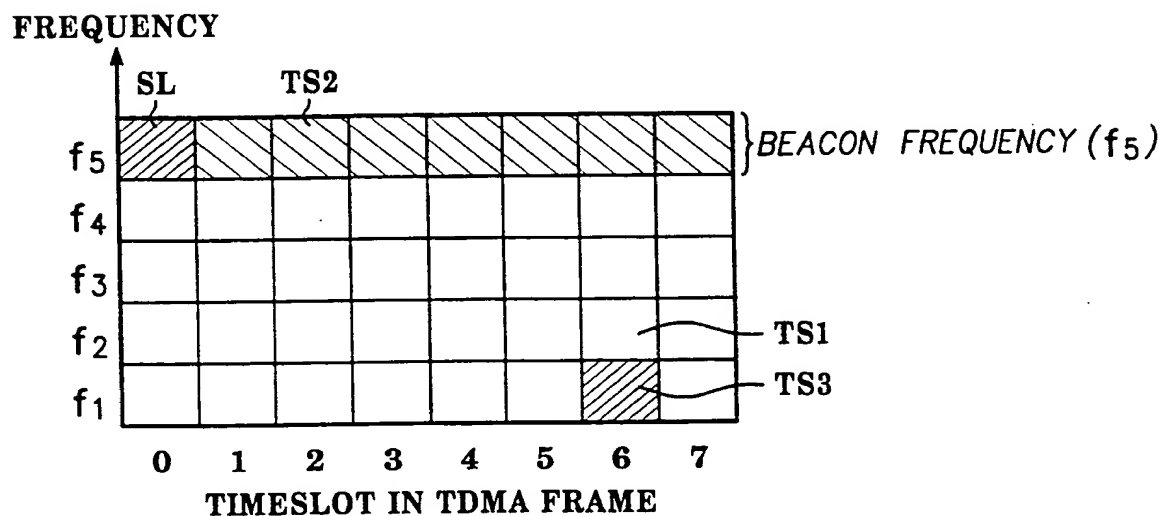
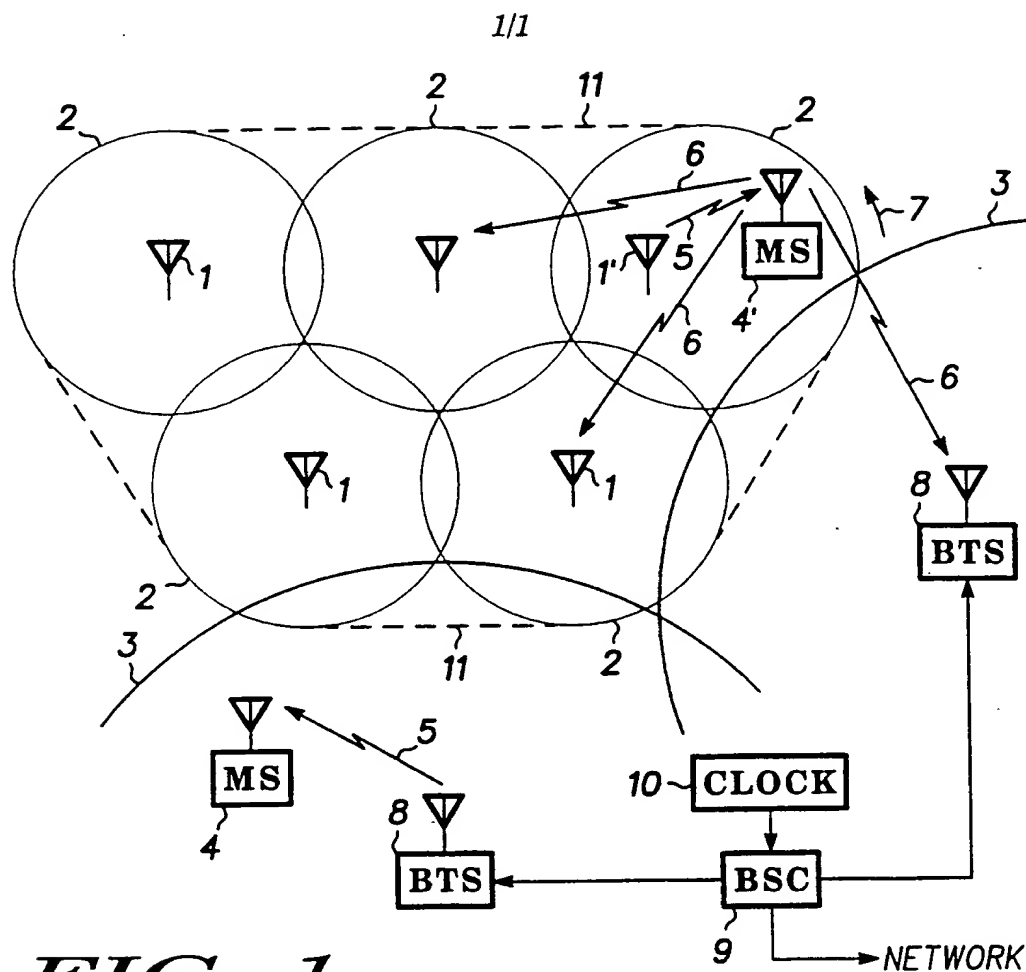


FIG. 2

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Continuation of Box No. III

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| <input type="checkbox"/> GB United Kingdom | <input type="checkbox"/> SK Slovakia |
| <input type="checkbox"/> GD Grenada | <input type="checkbox"/> SL Sierra Leone |
| <input type="checkbox"/> GE Georgia | <input type="checkbox"/> TJ Tajikistan |
| <input type="checkbox"/> GH Ghana | <input type="checkbox"/> TM Turkmenistan |
| <input type="checkbox"/> GM Gambia | <input type="checkbox"/> TR Turkey |
| <input type="checkbox"/> HR Croatia | <input type="checkbox"/> TT Trinidad and Tobago |
| <input type="checkbox"/> HU Hungary | <input type="checkbox"/> UA Ukraine |
| <input type="checkbox"/> ID Indonesia | <input type="checkbox"/> UG Uganda |
| <input type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input type="checkbox"/> IN India | <input type="checkbox"/> UZ Uzbekistan |
| <input type="checkbox"/> IS Iceland | <input type="checkbox"/> VN Viet Nam |
| <input type="checkbox"/> JP Japan | <input type="checkbox"/> YU Yugoslavia |
| <input type="checkbox"/> KE Kenya | <input type="checkbox"/> ZW Zimbabwe |
| <input type="checkbox"/> KG Kyrgyzstan | |
| <input type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input type="checkbox"/> KR Republic of Korea | |
| <input type="checkbox"/> KZ Kazakhstan | |
| <input type="checkbox"/> LC Saint Lucia | |
| <input type="checkbox"/> LK Sri Lanka | |
| <input type="checkbox"/> LR Liberia | |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☐
- ☐
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Supplemental Box*If the Supplemental Box is not used, this sheet should not be included in the request.*

1. If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the provisions of the Box in which the space was insufficient, in particular:

- (i) if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;
 - (ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;
 - (iii) if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of all designated States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;
 - (iv) if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;
 - (v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "Continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;
 - (vi) if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI.
 - (vii) if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.
2. If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded
3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below

Continuation of Box No. IV

IBBOTSON, Harry
 GIBSON, Sarah
 POTTS, Susan
 WILLIAMSON, Simeon
 HUDSON, Peter

All above attorneys/agents are members of Motorola, Inc., Intellectual Property Department and have the same address, telephone number and telegraphic address as indicated in Box IV.

Box No. VI		PRIORITY CLAIM		Further priority claims are indicated in the Supplemental Box <input type="checkbox"/>	
Priority of the following earlier application(s) is claimed:				Office with earlier application filed	
Filing Date of earlier application (day/month/year)	Number of earlier application	National application = country; regional application = regional Office	International application = receiving Office		
item (1) 10 JUNE 1998 (10.06.98)	9812409.2	UNITED KINGDOM			
item (2)					
item (3)					

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): _____

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities

are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): ISA/EP

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number:

Country (or regional office):

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

- | | | | |
|--|---|-----------|---------------|
| 1. request | : | 5 | sheets |
| 2. description (excluding sequence listing part) | : | 10 | sheets |
| 3. claims | : | 3 | sheets |
| 4. abstract | : | 1 | sheets |
| 5. drawings | : | 1 | sheets |
| 6. sequence listing part of description | : | 0 | sheets |
| Total | : | 20 | sheets |

This international application is accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 6. <input type="checkbox"/> translation of international application into (language): _____ |
| 2. <input checked="" type="checkbox"/> separate signed power of attorney | 7. <input type="checkbox"/> separate indications concerning deposited microorgs./biological mat. |
| 3. <input checked="" type="checkbox"/> copy of general power of attorney | 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form |
| 4. <input type="checkbox"/> statement explaining lack of signature | 9. <input type="checkbox"/> other (specify): copy, U.S. assignment |
| 5. <input checked="" type="checkbox"/> priority document(s) identified in Box No. VI as item(s): | |

Figure No. _____ of the drawings (if any) should accompany the abstract when it is published.

Language of filing of the international application:

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

MOTOROLA LIMITED

BY

**H. IBROTSON**

For receiving Office use only

THEIR ATTORNEY

1. Date of actual receipt of the purported international application:	2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article II(2):	
5. International Searching Authority specified by the applicant: <u>ISA/</u>	
6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid	

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

PCT
FEE CALCULATION SHEET
Annex to the Request

International application No.

Applicant's or agent's
file reference CE30418P/PCT

Date Stamp of the receiving Office

Applicant MOTOROLA LIMITED

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE 2200.00 ☐ T

2. SEARCH FEE 200.00 ☐ S

International search to be carried out by ISA/ EP
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains 20 sheets.
first 30 sheets

800.00 ☐ b₁

0 X 0 ☐ b₂

remaining sheets additional amount

Add amounts entered at b₁ and b₂
and enter total at B

800.00 ☐ B

Designation Fees

5 X 184.00 920.00 ☐ D

number of designations amount of designation fee
payable (maximum 10)

Add amounts entered at B and D and enter total as I

1720.00 ☐ I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable)

0.00 ☐ P

5. TOTAL FEES PAYABLE

Add amounts entered at T, S, I and P,
and enter total in the TOTAL box

4120.00

TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☒ authorization to charge ☐ bank draft ☐ coupons
deposit account (see below)

☐ cheque ☐ cash ☐ other (specify):

☐ postal money order ☐ revenue stamps

DEPOSIT ACCOUNT AUTHORIZATION

The RO/ EP ☒ is hereby authorized to charge the total fees indicated above to my deposit account

☒ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☒ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

28050071

18 May 1999

Deposit Account Number

Date (day/month/year)

Signature LEEOTSON, HARRY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference CE30418P/PCT	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/EP 99/ 03732	International filing date (day/month/year) 26/05/1999	(Earliest) Priority Date (day/month/year) 10/06/1998
Applicant MOTOROLA LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference CE30418P/PCT	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/EP 99/ 03732	International filing date (day/month/year) 26/05/1999	(Earliest) Priority Date (day/month/year) 10/06/1998
Applicant MOTOROLA LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP 99/03732

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H0407/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 196 29 899 C (NOKIA MOBILE PHONES LTD.) 21 August 1997 (1997-08-21) ---	1
A	WO 93 22849 A (NOKIA TELECOMMUNICATIONS OY.) 11 November 1993 (1993-11-11) abstract page 11, line 26 -page 12, line 9 -----	1

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

17 September 1999

Date of mailing of the international search report

27/09/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Danielidis, S

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

P 99/03732

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19629899 C	21-08-1997	JP 10145871 A US 5920547 A	29-05-1998 06-07-1999
WO 9322849 A	11-11-1993	FI 922046 A AT 172828 T AU 4262893 A DE 69321831 D DE 69321831 T EP 0639312 A JP 7506472 T NO 944217 A US 5570352 A	07-11-1993 15-11-1998 29-11-1993 03-12-1998 22-04-1999 22-02-1995 13-07-1995 03-01-1995 29-10-1996

INTERNATIONAL COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
MOTOROLA
Europ. Intell. Property Operations
Attn. Ibbotson, Harry
Midpoint
Alencon Link
Hampshire RG21 7PL
UNITED KINGDOM

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

EUROPEAN

29 SEP 1999

DATE of mailing
(day/month/year)
PATENT
DEPT.

27/09/1999

Applicant's or agent's file reference

CE30418P/PCT

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/EP 99/ 03732

International filing date

(day/month/year)

26/05/1999

Applicant

MOTOROLA LIMITED et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

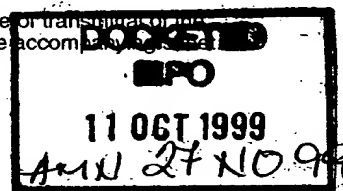
Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.



2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

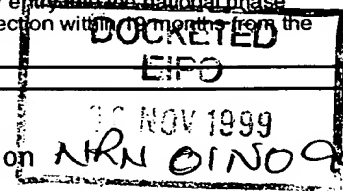
☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.



Name and mailing address of the International Searching Authority

European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Hans Pettersson

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

TENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 06 March 2000 (06.03.00)	Applicant's or agent's file reference CE30418P/PCT
International application No. PCT/EP99/03732	Priority date (day/month/year) 10 June 1998 (10.06.98)
International filing date (day/month/year) 26 May 1999 (26.05.99)	Priority date (day/month/year) 10 June 1998 (10.06.98)
Applicant THOMAS, Howard et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

10 January 2000 (10.01.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).


The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Nestor Santesso Telephone No.: (41-22) 338.83.38
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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference CE30418P/PCT		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP99/03732	International filing date (day/month/year) 26/05/1999	Priority date (day/month/year) 10/06/1998	
International Patent Classification (IPC) or national classification and IPC H04Q7/38			
Applicant MOTOROLA LIMITED et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none">I <input checked="" type="checkbox"/> Basis of the reportII <input type="checkbox"/> PriorityIII <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicabilityIV <input type="checkbox"/> Lack of unity of inventionV <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statementVI <input type="checkbox"/> Certain documents citedVII <input type="checkbox"/> Certain defects in the international applicationVIII <input checked="" type="checkbox"/> Certain observations on the international application			
Date of submission of the demand 10/01/2000		Date of completion of this report 21.09.2000	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer Pais Gonçalves, A Telephone No. +49 89 2399 8806	



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP99/03732

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-10 as originally filed

Claims, No.:

1-13 as originally filed

Drawings, sheets:

1/1 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP99/03732

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-13
	No: Claims
Inventive step (IS)	Yes: Claims 1-13
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-13
	No: Claims

2. Citations and explanations

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP99/03732

V.

1. The present invention relates to a mobile communication network (Claim 1), a base station (Claim 12) and to a method of operating the network (Claim 13), wherein an intracell handover of a mobile station is performed to a common simulcast carrier and then performing measurements of the signal quality.
2. This solution avoids the situation of the conventional mechanisms when the measurements are performed with the base stations re-tuning to the frequencies of the traffic carriers. Since such frequencies are reused, the measured signal is a signal of the desired mobile station combined with the signals of other mobile stations allocated to the same time slot in cells using the same traffic carrier frequency. In other words, the measurements may be inaccurate.
3. The above-referred solution is not disclosed in or rendered obvious by the available prior art and Claims 1, 12 and 13 fulfil thus the requirements of Article 33(1) PCT in respect of novelty, inventive step and industrial applicability. The same applies to dependent Claims 2 to 11, which contain further refinements of the main embodiments of Claim 1.

VIII.

1. Claims 1, 12 and 13 are **not clear** (Article 6 PCT) because it is not clear what is meant by "to intermittently perform an intracell handover" or how this action is controlled. In addition, it is also not clear when such action has to be performed.